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State of Connecticut

REPORT

OF

The Connecticut Agricultural Experiment Station

TENTH REPORT OF THE STATE ENTOMOLOGIST, 1910

W. E. BRITTON, PH.D.

BEING PART IX OF THE BIENNIAL REPORT OF 1909-1910

TENTH REPORT

OF THE

STATE ENTOMOLOGIST

OF

CONNECTICUT

FOR THE YEAR 1910

BY

W. E. BRITTON, PH.D.

State Entomologist

New Haven, Conn.

1911

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ILLUSTRATIONS.

Figure 22 is from the Bureau of Entomology of the U. S. Department of Agriculture. All other text figures are from pen drawings by Mr. A. B. Champlain, assistant in this department.

All plates are from photographs made by Mr. B. H. Walden of this department.

PART IX.

TENTH REPORT

OF THE

STATE ENTOMOLOGIST OF CONNECTICUT

To the Director and Board of Control of the Connecticut Agricultural Experiment Station:

I hereby transmit my tenth annual report as state entomologist of Connecticut. The work has been conducted along the same lines as last year, and shows an increasing amount of inspection and control work, due chiefly to the discovery on December 14, 1909, of a gypsy moth colony at Wallingford; to the apiary inspection work imposed upon this office by the last General Assembly; and to the increase in the imports of nursery stock into the state.

The financial report is for the state fiscal year ending September 30th, but the remainder of the report covers the calendar year of 1910.

Respectfully submitted,

W. E. BRITTON,
State Entomologist.

REPORT OF THE RECEIPTS AND EXPENDITURES OF THE STATE ENTOMOLOGIST FROM OCTOBER 1ST, 1909, TO SEPTEMBER 30TH, 1910.

Insect Pest Account.

RECEIPTS.

From E. H. Jenkins, Treasurer	$3,000.00	
Account of 1908, balance	1,151.86	
Sale of lantern slides and electrotypes	3.65	
		$4,155.51

EXPENDITURES.

For field, office and laboratory assistance	$1,976.26	
Printing and illustrations	354.90	
Postage	51.23	

Stationery	$ 8.50	
Telegraph and telephone	3.60	
Express, freight and cartage	39.24	
Library	171.50	
Laboratory apparatus and supplies	145.44	
Spraying supplies	14.35	
Office supplies	53.98	
Traveling expenses	244.55	
Balance, cash on hand	1,091.96	
		$4,155.51

Gypsy Moth Control Account.

RECEIPTS.

From E. H. Jenkins, Treasurer	$4,150.00	
Account of 1909, balance	410.22	
		$4,560.22

EXPENDITURES.

For salary of superintendent, and labor	$3,725.66	
Printing	77.00	
Tools and supplies	498.42	
Express, freight, and cartage	30.58	
Traveling expenses	210.61	
Balance, cash on hand	17.95	
		$4,560.22

Memorandum:—This account of the state entomologist has been duly audited by the State Auditors of Public Accounts.

PUBLICATIONS BY THE ENTOMOLOGIST, 1910.

The Official Entomologist and the Farmer. *Journal of Economic Entomology,* Vol. III, p. 12. 8 pages.

Report of Committee on Injurious Insects, W. E. Britton, Chairman. Read at the annual meeting, February 3, 1910. Report of the Connecticut Pomological Society, 1910, p. 145. 4 pages.

Ninth Report of the State Entomologist (Part IV of the Station Report for 1909-1910); 52 pages, 9 text figures, 16 plates; 9,000 copies distributed in May, 1910.

Notes of the Season in Connecticut. *Journal of Economic Entomology,* Vol. III, p. 434. 2½ pages.

Spraying to Destroy the San José Scale in Connecticut. *The National Nurseryman,* March, 1910, p. 510.

The Gypsy Moth in Connecticut. *Guide to Nature,* June, 1910, p. 84. 2 pages. (Illustrated.)

The following articles were printed in the *Connecticut Farmer* under the dates given below:

White Grubs in Grass Lands. February 19, 1910.

Elm Leaf Beetle. April 2, 1910. (Also issued as a correspondence slip.)

Canker Worms. April 9, 1910. (Illustrated.)
Progress of the Gypsy Moth Work at Wallingford. April 9, 1910.
The Bud Moth *Tmetocera ocellana* Schiff. May 21, 1910.
Cutworms. June 4, 1910. (Also issued as a correspondence slip.)
Some of the More Important Insects Found in Connecticut. June 11, 1910. (Illustrated.)
The Maple Borer. July 9, 1910. (Illustrated.)
The Gypsy Moth Infestation at Wallingford. July 16, 1910. (Illustrated.)
A Pest of Birch Trees in Connecticut, *Bucculatrix canadensisella* Chamb. September 24, 1910.

DEPARTMENT STAFF.

W. E. BRITTON, PH.D. ..... *State and Station Entomologist.*
B. H. WALDEN, B.AGR. ..... *Assistant.*
DONALD J. CAFFREY, B.AGR. ..... *Assistant.*
ALFRED B. CHAMPLAIN ..... *Assistant.*
MISS E. B. WHITTLESEY ..... *Stenographer.*

Mr. G. H. Hollister, who for three years has had charge of the gypsy moth work, was appointed to a more lucrative position in Keney Park, Hartford, and left this department about October 15th, 1909. He is now foreman of Keney Park. Mr. Donald J. Caffrey, a graduate of the Massachusetts Agricultural College, was secured and took charge, on January 24th, of the gypsy moth work at Wallingford, which was continued until the last of August, when Mr. Caffrey was transferred to the work of inspecting nurseries until November 1st, when he returned to the gypsy moth work.

Mr. Alfred B. Champlain, formerly of the laboratory of the Economic Zoölogist at Harrisburg, began his duties as assistant April 1st. He has assisted in the inspection of imported nursery stock and of the Connecticut nurseries, and has made a number of charts and drawings and done considerable work on the insect collection, as he is a specialist in the family Carabidæ of the beetles.

Mr. B. H. Walden has continued as general assistant, and has had charge of the work of the office in my absence. He has also done most of the photographic work of the department. Miss Elizabeth B. Whittlesey has also continued her work as stenographer, assisting each morning in the correspondence and the necessary indexing and filing of the office. During her

absence Miss K. E. Flynn and Miss M. K. Falsey were each employed for a short time. All of the persons mentioned have rendered satisfactory services, and their work is appreciated.

Chief Lines of Work.

The work of this department has been conducted along lines similar to that of last year, and shows an increased amount of inspection and control work, due principally to the discovery on December 14th, 1910, of a gypsy moth colony at Wallingford; to the apiary inspection imposed upon this office by the last General Assembly, and to the increase in the imports of nursery stock into the state. Nursery and orchard inspection has been carried on as usual.

In addition to the inspection and control work which is described in the following pages, this department has coöperated with the botanical department in conducting a series of experiments in the spraying of apple and peach orchards in summer to control their various insect and fungous enemies. About 350 apple trees in seven different orchards, with 75 others reserved as checks, and 125 peach trees in three different orchards, with half as many checks, were under experimentation. An account of this work in detail, with the results obtained, has been published as Part VII of this report.

A number of commercial insecticides, mostly lime and sulphur preparations for destroying San José scale, have been tested in a small way, and similar tests have been made with some of these mixtures in destroying the eggs of plant lice on apple trees.

The entomologist is now preparing a check list of the insects which have actually been collected in Connecticut.. This will be published by the Geological and Natural History Survey of the state. Mr. Walden's paper on the Orthoptera of the state, finished some time ago, is now in press and will soon be issued as Bulletin 16 of the Survey. The paper on the Hymenoptera, prepared some time ago by Mr. Viereck, must await the action of the General Assembly before it can be published, as the funds for publishing will be exhausted before it can be reached.

The brown-tail moth has made its appearance in this state at Thompson and Putnam, and some scouting and spraying has been done because of it.

Brief studies have been made on two kinds of moths, the caterpillars of which we found on imported nursery stock from Japan; a Phorid fly infesting onion seeds in the germinator; a lepidopterous larva feeding on barberry; also observations on the 15-spotted lady beetle, birch bucculatrix, elm leaf beetle, San José scale, canker worms, and the various injurious and beneficial species that are sent for identification and that we run across in our field work.

Where such studies are in any sense complete, or where new facts have been brought out, the matter has been given more extended notice in the following pages.

Summary of Inspection and Office Work.

326 samples of insects received for identification.
47 orchards and gardens examined for insects.
47 nurseries inspected.
44 certificates granted. One certificate revoked.
707 boxes, bales and packages imported nursery stock examined.
208 apiaries containing 1,595 colonies inspected.
158 apiaries containing 793 diseased colonies found infested with European foul brood disease.
44 second inspections made.
1,881 letters written on official work.
61 packages sent out.
17 addresses made before granges, farmers' institutes and village improvement associations.

Exhibits.

As part of the general exhibit of the station this department exhibited insects and their work at five agricultural fairs during the fall. Beginning September 6th and ending October 8th, going to a different place each week, exhibits were made at Norwich, Willimantic, Rockville, Berlin and Danbury. Though much time was required to prepare these exhibits, they were seen by thousands of people, many of whom learned for the first time of the entomological work of the station.

The exhibit of the entomological department contained many pinned specimens illustrating the more important orders or groups of insects, including butterflies and moths, dragon flies, beetles, grasshoppers, crickets, flies, bees, bugs and scale-insects. There was also one case each devoted to gall insects, garden insects, fruit insects, forest insects and beneficial insects. Several

life history sets of well-known insect pests and common species were shown, as well as large charts of the former, and a number of insecticides and spray nozzles.

The gypsy moth, against which the state of Massachusetts has expended nearly $2,000,000, and which is present in Connecticut at Wallingford and Stonington, was the subject of a part of the exhibit, and was accompanied by figures showing the results of the work in Connecticut.

A feature of the exhibit which usually attracts attention was the living caterpillars and mosquito larvæ or wrigglers, and many paused to look at the latter and expressed their surprise to learn that they turn into mosquitoes—but the proof was before them. The exhibit of insects was also supplemented by over one hundred photographs of insects and their work, and by some of the publications of the state entomologist.

New Quarters.

The entomological department moved June 20th, 1910, into its new quarters on the second floor of the new brick addition, for the building and equipment of which the last General Assembly made an appropriation of $30,000. Much better facilities for work are now afforded than ever before. Including insectary, dark-room and storage closet, 1,500 square feet of floor space are now occupied by the department, apportioned as follows: Office and library, 14½ x 21½ ft.; collection room, 21½ x 27 ft.; laboratory, 19 x 22½ ft.; insectary, 6 x 16 ft.; and dark-room, 7½ x 8 ft. (both opening out of laboratory); storage closet, 4 x 7 ft. The office, collection room, laboratory and storage closet all open from the hall. The collection room is connected with both office and laboratory, and the latter is provided with closets, drawers, microscope tables, hood and sink. The collection room has three west and two north windows, and the laboratory has three north and two east windows, so that an abundance of north light is available. The rooms are heated by steam and lighted by both gas and electricity, and gas and electric outlets are conveniently arranged for all kinds of laboratory work. In the basement a room 21 x 26½ ft. is used jointly by the entomological and botanical departments for a display of insecticides, fungicides, pumps and spraying apparatus.

Entomological Features of 1910.

The season of 1910 brought a comparative scarcity of plant lice, and especially of the rosy apple aphis, which was so abundant and caused such damage to apple trees in Connecticut in 1909. In some orchards it was necessary to search a long time in order to find a single colony, and in no case did it cause injury. The 15-spotted lady beetle, *Anatis 15-punctata* Oliv., was extremely abundant, more so than I have ever seen it before, and from fifteen to twenty egg-clusters, containing altogether several hundred eggs, could be found on nearly every tree.

The green apple aphis, *Aphis pomi* DeG., was present in moderate numbers, as in 1909.

Canker worms, chiefly the fall species, *Alsophila pometaria* Harr., were abundant, and their devastation was widespread throughout the state on many different kinds of trees. It was especially noticeable, however, on apple trees, and many orchards were brown in early summer, as if scorched by fire. Mr. Champlain observed a large ground beetle, *Calosoma willcoxi* Lec., which was very abundant during the season, feeding upon canker worms, and some of the helpers on the station grounds saw a grey squirrel devour about forty canker worms on the trunk of an oak tree below the Tanglefoot band.

The elm leaf beetle, *Galerucella luteola* Müll., did a great deal of damage in certain parts of the State, especially in Thompson and in Glastonbury, according to reports received from correspondents. In some other places, however, like New Haven and Milford, where a careful and systematic spraying of the trees was practiced in 1909, the beetles were rather scarce, and some observers apparently thought that the pest was on the wane and would give us no further trouble. These towns and cities, however, sprayed their trees again in 1910, and the trees, especially in New Haven, presented a better appearance toward the end of the summer than for many years. The spraying should be continued.

Cut worms were especially troublesome, and much damage to tobacco fields and gardens in June was reported to this office.

June beetles were very abundant early in the season, as might be expected from the damage to grass lands in 1909 from white grubs. June beetles defoliated trees in the vicinity of New London.

Rose beetles were also present in rather more than their usual numbers, and caused the ordinary amount of damage in gardens and vineyards.

Sawfly larvæ of several uncommon kinds were observed feeding upon plants not usually attacked, and an attempt was made to rear the adults of several species. The peach sawfly, *Pamphilius persicum* MacG., defoliated many trees in some of the large peach orchards, and though I have not heard of any attempt to check its ravages by spraying, some of the orchardists are now planning to spray their trees in 1911 with lead arsenate to prevent a repetition of the injury.

Sphinx larvæ were scarce in 1910, and nearly all of those observed were strongly parasitized. This was particularly true of the common tobacco or tomato worm, as every caterpillar which we collected showed before pupation the cocoons of *Apanteles congregatus* Say.

The brown-tail moth, *Euproctis chrysorrhœa* Linn., made its appearance in the state at Thompson in April, and was later found at Putnam. For several years this pest has been known to be near the borders of our state in Massachusetts and Rhode Island, but until this season it has not been found in Connecticut except on nursery stock imported from France. On other pages of this report are given accounts of this insect, and its occurrence in Windham County and on imported nursery stock.

During the latter part of August and during September the birch trees known as the white, grey, or bobbin birch, were stripped of their leaves throughout the northern and eastern portions of the State. The insect causing this defoliation was the birch bucculatrix, *Bucculatrix canadensisella* Chamb., a pest of northern New England and found in certain seasons in Massachusetts and Rhode Island; but it has not during my residence of over sixteen years in Connecticut shown any such outbreak. A fuller account of this insect is included in this report.

The increasing damage to shade trees by the leopard moth, *Zeuzera pyrina* Linn., which is boring in the branches of various kinds of trees in the cities, should be mentioned here; also that of the woolly maple leaf scale, *Phenacoccus acericola* King, which in Connecticut confines its attacks chiefly to sugar maples. The sugar maple borer, *Plagionotus speciosus* Say, is still a seri-

ous pest of sugar maple shade trees in towns and cities. Over sixty adult beetles were taken from the trunks of the street trees of Wallingford last summer by the gypsy moth men during their work of turning bands.

The San José scale has apparently diminished somewhat in its virulence or powers of spread and injury. Several instances have come to my notice where old apple trees which were infested several years ago, and which I thought would be dead before this, have taken on a new lease of life, and on examining them I find very few living scales. There seems to be no particular natural enemy that is responsible for the welcome check in the spread of this hitherto serious and destructive orchard pest.

Cabbage loopers, *Autographa brassicæ* Riley, have been common during the season, and in some fields apparently did even more damage than the cabbage worm. The remedy, however, is the same.

Two kinds of insects, both lepidopterous larvæ, have been brought into this country on nursery stock from Japan. One, feeding upon a deciduous shrub resembling lilac, was reared, and the adult finally identified as *Hemiscopis cinerea* Warren, which is mentioned elsewhere in this report. The other was feeding upon a conifer, *Abies tomomi,* and was found in shipments sent to two Connecticut nurseries. The adult stage, however, was not obtained.

Inspection of Connecticut Nurseries.

The inspection of growing nursery stock was commenced September 1st, and completed about November 1st. It was done by Messrs. Walden, Caffrey, Champlain and Britton.

On the whole the nurseries were in better condition as regards the scale than for several years. This is probably due to the increased care and attention given the growing nursery stock by some nurserymen and to the diminished power of multiplication of the San José scale.

The list of nurserymen changes slightly from year to year. This year's list contains forty-two names as against forty-seven last year and forty in 1908. Of these, six have been dropped, though three of them may receive certificates when they have carried out the directions of the state entomologist in regard to the treatment of infested stock. One has been added since last

year, and another nursery has changed hands. Altogether forty-eight nursery inspections were made during the year, forty-four certificates were granted, and one of these was revoked on account of the nurseryman moving his business elsewhere.

The list follows:

LIST OF NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1910.

Name of Firm.	Location.	Certificate issued.	Number of certificate.
Atwater, C. W.	Collinsville	Oct. 7,	383
Barnes Bros. Nursery Co.	Yalesville	Oct. 13,	386
Beattie, Wm. H.	New Haven	Nov. 12,	412
Bowditch, J. H.	Pomfret Center	Sept. 24,	376
Brainard, D. Wm. & C. F.	Thompsonville	Nov. 12,	409
Braley & Co., S. A	Burnside	Oct. 4,	382
Brooks Bros.	Westbrook	Oct. 1,	379
Burroughs, Thos. E.	Deep River	Sept. 30,	378
Burr & Co., C. R.	Manchester, Buck Land, Durham,	Sept. 20,	374
Chapman, C. F.	North Stonington	Oct. 27,	399
Comstock & Lyon	Norwalk	Oct. 24,	396
Conine Nursery Co., The F. E.	Stratford	Oct. 8,	384
Conn. Agricultural College	Storrs	Nov. 5,	408
Conn. Agr. Experiment Station, Forest Nursery (S. N. Spring, State Forester, New Haven)	New Haven and Rainbow	Nov. 12,	411
Conway, W. H.	New Haven	Oct. 24,	398
Cross Highway Nurseries	Westport (2)	Oct. 28,	404
Dehn & Bertolf	Greenwich	Oct. 14,	387
Dwyer, John E.	Manchester	Sept. 15,	373
East Rock Park Nursery (G. X. Amrhyn, Supt.)	New Haven	Sept. 20,	375
Elm City Nursery Co.	New Haven	Sept. 27,	377
Fernwood Nursery	Stamford	Oct. 20,	390
Hale, J. H.	So. Glastonbury	Nov 2,	405
Houston & Sons, J. K.	Mansfield Depot	Nov. 1,	407
Hoyt's Sons Co., Stephen	New Canaan	Oct. 3,	380
Hubbard & Co., Paul M.	Bristol	Oct. 28,	401
Hunt & Co., W. W.	Hartford	Oct. 21,	392
Kelsey & Sons, David S.	West Hartford	Dec. 22,	418
Keney Park Nursery (G. A. Parker, Supt.)	Hartford	Dec. 8,	413
Mount Carmel Forest and Nursery Co.	Mt. Carmel	Nov. 2,	406
North-Eastern Forestry Co.	Cheshire and East Haven	Oct. 27,	400
New Haven Nursery Co.	New Haven	Oct. 18,	388
Phelps, J. Wesson	Bolton	Nov. 3,	404

Name of Firm.	Location.	Certificate issued.	Number of certificate.
Pierson, A. N.	Cromwell	Oct. 13,	385
Platt Co., The Frank S.	New Haven	Oct. 28,	402
Purinton, C. O.	Hartford	Dec. 12,	414
Rosemore Nursery Co.	Litchfield	Oct. 24,	395
Schleichert, F. C.	Bridgeport	Oct. 20,	391
Schoonman, W. J.	Danielson	Oct. 24,	397
Scott, J. W.	Hartford	Oct. 22,	393
Sierman, C. H.	Hartford	Nov. 12,	410
Vidbourne & Co., J.	Hartford	Oct. 19,	389
Woodruff, C. V.	Orange	Oct. 29,	403

INSPECTION OF IMPORTED NURSERY STOCK.

By W. E. Britton and B. H. Walden.

On account of our experience the previous year (see Report of this Station for 1909-10, page 328) in finding nests of the brown-tail moth on nursery stock imported from France, and in the continued absence of any system of Federal inspection of such stock, in order to protect the state from wholesale and rapid infestation with this most undesirable pest, an attempt was made to inspect all woody nursery stock brought into Connecticut during 1910. We were notified of many shipments by Dr. L. O. Howard of the Bureau of Entomology at Washington, and of others by Mr. George G. Atwood, who has charge of the nursery inspection work in the State of New York. Thanks are due to both these men for many courtesies extended to us in this matter. There were some shipments, however, which we could not trace, and some arrived unheralded and were duly inspected. The total amount of nursery stock imported into Connecticut in 1910 was more than twice that of 1909, according to our records of the stock examined.

On January 31st, 1910, the following letter was sent to every Connecticut nurseryman:

New Haven, Conn., Jan. 31, 1910.

Dear Sir:—Last winter thousands of nests of the Brown-tail Moth, *Euproctis chrysorrhœa* Linn., were brought into the United States on nursery stock from France, and in the absence of any system of Federal inspection, this infested stock was shipped into nearly all of the Eastern States. Fifty-two of these nests were found on stock shipped into Connecticut, out of 224 boxes and packages examined. Again this winter

these nests have been found on rose stock from France brought into New York State, and if such stock is not inspected, the Eastern nurseries will soon become infested and the business seriously injured.

I therefore request you to notify me at once of any importations received during the fall or winter not already inspected, or of any shipments expected this spring, so that an inspection can be made. Please hold all boxes and packages without unpacking until an inspector can reach your nursery. We will examine the stock as promptly as possible after receiving notice that the goods have arrived at your nursery.

Very truly yours,

W. E. BRITTON,
State Entomologist.

In reply to this letter the nurserymen as a rule promptly notified this office of the arrival of stock, and some of them put themselves to much inconvenience and furnished labor at considerable expense to aid the inspection work. There were a number of small packages consigned to private places which were planted out or distributed among friends, and could not be examined. The inspection work was done by Messrs. Walden, Champlain and Britton, and of course a large proportion of this stock arrived in March and April. In all 707 boxes, bales and packages were examined, coming from nine different countries. Fewer brown-tail nests were found than last year, but fourteen of these were found in five cases of pear, apple and rose stocks brought into three Connecticut nurseries in widely separated localities. The nests came from three different French nurseries—André Leroy, Angers, two nests on pear; Franco-American Seedling Company, Angers, nine nests on apple; and E. T. Dickinson, Chateny, three nests on *Rosa multiflora*.

All stock from the infested boxes was dipped, root and branch, in Scalecide (1–20), and all the packing material was treated in the same way or else burned to destroy any caterpillars which might have crawled from the nests.

In addition to the brown-tail nests, two shipments of ornamental stock from Japan contained living caterpillars, one of *Hemiscopis cinerea* Warren (described elsewhere in this report) on a deciduous shrub resembling lilac, and an undetermined larva feeding on *Abies tomomi* and appearing to be capable of doing considerable damage.

The inspection of this imported stock required an amount of time equivalent to one man's work for more than two months.

One man could not have examined it all, however, without great delay and in some cases serious injury to some of the stock. In the rush of the season the services of three men were required on some days, all in different nurseries.

SOURCES OF IMPORTED NURSERY STOCK.

Holland	376
France	104*
Belgium	91
England	63
Japan	26
Scotland	19
Ireland	18
Germany	9
Russia	1
Total	707

INSPECTION OF APIARIES.

The last General Assembly made provision for the inspection of Connecticut apiaries on account of the diseases known as "foul brood," and the inspection work was placed in charge of the state entomologist. The law took effect at the beginning of the fiscal year, October 1st, 1909, but it was too late to make any inspection of apiaries until the following spring. Following the provisions of the act, however, inspectors were appointed as follows: Mr. A. W. Yates of Hartford for the northern half of the state, including Litchfield, Hartford, Tolland and Windham counties: Mr. H. W. Coley of Westport for the southern half, including Fairfield, New Haven, Middlesex and New London counties.

The full text of the act is as follows:

AN ACT CONCERNING THE SUPPRESSION OF CONTAGIOUS DISEASES AMONG BEES.

Chapter 185 Public Acts of 1909.

SECTION 1. *Duty of state entomologist to act on complaint.* For the purpose of suppressing contagious or infectious diseases of the honey bee, it shall be the duty of the state entomologist, when complaint is duly made, to examine and verify, and treat or destroy cases of foul brood among honey bees.

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*Five cases of stock from three French nurseries, shipped to three Connecticut firms, were infested with fourteen nests of the brown-tail moth.

Sec. 2. *Authority to appoint inspectors and to examine apiaries.* In pursuance of the provisions of this act, the state entomologist or any person whom he may appoint for that purpose shall have access at reasonable times to such apiaries or places where bees are kept and where honeycomb and appliances are stored as may be designated in any such complaint.

Sec. 3. *Authority to make regulations.* The state entomologist is authorized and empowered to prescribe suitable forms for and make regulations regarding such complaints, and shall keep the same on file and open to public inspection; and he is further authorized and empowered to make, in his discretion, reasonable rules to govern, and reasonable payments for the services of agents whom he may appoint to carry out the provisions of this act.

Sec. 4. *Obstruction illegal. Penalty.* Any person who impedes, resists or hinders the state entomologist or any agent whom he may appoint in the performance of the duties imposed by this act shall be fined not more than twenty-five dollars.

Sec. 5. *Provision for defraying expenses.* To carry out the provisions of this act the necessary expenses, to an amount not exceeding five hundred dollars, shall be paid by the comptroller on duly accredited vouchers.

Approved August 2, 1909.

Though inspections can be made only on complaint a man can sign a complaint against his own apiary, and this was done in perhaps a majority of cases. The complaints were sufficient to exhaust the appropriation during the first season. The inspections began the last week of April and were finished by the end of August. In all 208 apiaries, containing 1,595 colonies or hives of bees, were inspected. Of this number 138 apiaries and 749 colonies were found infested with European foul brood, *Bacillus alvei*. In all cases the inspector either treated the diseased colonies or instructed the owner how to treat them. If in the last stages, the colonies were usually destroyed by fire, but if only slightly diseased, the bees were shaken out on to new frames and foundation and placed in a clean hive, and the old hives and sometimes the frames were disinfected by scorching. The second inspections showed great improvement, and in most cases entire freedom from the disease.

The European foul brood was thus found in twenty-five towns of the state. In seven towns where inspections were made no diseased colonies were found, but in these cases only one or two, or at most but a few apiaries were inspected. So it is not fair to assume that the foul brood does not exist in these towns, as further work is almost certain to reveal it. So far, most of

the inspecting work has been done in Fairfield, Hartford and Windham counties. Very few inspections have been made in Middlesex, New London and New Haven counties, and none in Litchfield and Tolland counties. It is probable, however, that considerable foul brood will be found in nearly all parts of the state as soon as anyone looks for it. Other portions of the state will be examined as soon as additional funds are available for the work.

A card catalogue in duplicate, one arranged alphabetically and one by towns, is on file in this office. It is desirable to have this catalogue as complete as possible, and it should contain the name and address of every beekeeper in the state. All records available, such as number of colonies, date and result of inspections, etc., are placed on these cards for future reference. We therefore request all readers to coöperate by sending in names of beekeepers known to them, especially those who are not members of the Connecticut Beekeeper's Association.

SUMMARY OF APIARY INSPECTION.

Number, first inspection	298	1,548
Infested with European Foul Brood	158	783
Number, second inspections	44	
Number of towns containing diseased bees	25	
" " where disease was not found	7	
Money expended	$	$490 83
Average cost per apiary		2 40

Other troubles reported by the inspectors:

Paralysis	2 cases
Spring Dwindle	2 "
Wax Moth	1 case
Poisoned from sprayed trees	3 cases

CONTROLLING THE GYPSY MOTH IN CONNECTICUT.

WALLINGFORD INFESTATION.

The discovery of the gypsy moth at Wallingford in December, 1909, was recorded in my last report. (See Report of this Station for 1909-10, page 387.) Immediate steps were taken to eradicate the scourge, and at first helpers from the station were

sent to creosote the egg-masses which were in plain sight in order to destroy them before the eggs were scattered. On January 24th Mr. Donald J. Caffrey took charge of the field work as superintendent, and resided in Wallingford through the spring and summer. He was given authority to hire and discharge whomever he saw fit, under certain regulations. At first he employed but few men, and worked with them, teaching them how to do the different parts of the work. As opportunity offered, other men were taken on, and the best ones retained. There was pruning and scraping, carting and burning of brush, filling and tinning of cavities, in connection with the trees and fences, rubbish and outbuildings to overhaul during the winter, besides a careful examination of the entire village and the surrounding country to ascertain the limits of the infested area. Mr. Caffrey did much of the scouting himself, besides looking after the men, and the results of the work are largely due to his faithfulness and thoroughness.

It may be stated here that no infestation has been found outside of the village of Wallingford, though much hunting has been done by state and Federal scouts, and the map on page 339 of the last report still shows very accurately the location of the infestation. The only change to be made is in extending the area in its southern portion eastward across Fair Street to Elm Street. According to computations made by Mr. R. W. Bolton, the area in Wallingford actually infested with the gypsy moth equals only 0.378 of a square mile. In the summer the trees throughout the infested section and in a surrounding zone were banded with burlap to trap any stray caterpillars or to catch those hatching from any egg-cluster which might have been overlooked. Some of these bands were turned each day during the caterpillar season, and all were examined frequently, and all caterpillars found were destroyed. Nearly all of the trees known to be infested were sprayed with arsenate of lead to kill the caterpillars feeding upon the foliage, in the hope of making sure of some in this way that might escape the bands.

Tree Tanglefoot bands were applied to many trees for the purpose of preventing the caterpillars from going up or down the trunk or branch of the tree. This material is effective in many cases where it is impossible or impracticable to catch the caterpillars under burlap or by spraying with poison. There

are sometimes egg-masses in cavities of trees or holes in fences which cannot be reached or covered, and by placing a band of Tanglefoot entirely around the spot, the young caterpillars are caught in it on leaving the nest for their food. Thousands of young caterpillars were killed in this way.

At the end of the caterpillar season in August, the bands were removed from the trees and all work suspended until November 1st, when the leaves were off the trees and scouting for egg-masses could be done to advantage.

I wish to express here my hearty appreciation of the spirit of coöperation which was manifested by the town and borough officers, who supplied help in the first days of the work; furnished storage room for tools and supplies; loaned us ladders, and caused several back yards to be cleared of rubbish. The residents and property owners generally have shown interest in the matter and have coöperated with us. Nearly all seemed anxious to help clean up the infested territory, and this work was greatly furthered by the efforts of the Village Improvement Association, which culminated in a "clean-up day" on March 25th, when much rubbish was carted to the Whittlesey Avenue dump and burned under the direction of our men. The only hindrance encountered was from an insane man on Franklin Street, who drove the men off his grounds and tore the bands from his trees, but he was removed to a retreat early in the season, and after that his trees were properly treated.

Scouting for Egg-masses.

As the egg-clusters were very abundant in the worst infested centers, nearly 6,000 were found and destroyed by the station helpers during the first two weeks of the work at Wallingford. Then a heavy snow prevented effective work for a month. This first work had been hurried, as it was important that all exposed egg-clusters be treated at once so that if they were broken and the eggs scattered, as was sure to happen with some of them, the eggs would not hatch. Birds undoubtedly break open some of the clusters, and those on the trunks of trees are often scattered by boys scraping them off or by horses rubbing against them. Many of those first found in Wallingford had been broken and the eggs scattered in this manner. When Mr. Caffrey and his men began, therefore, most of the prominent egg-masses had been

found and creosoted, but it was necessary to hunt for them in cavities of trees, under fence rails, under verandas, in tin cans, and in various out-of-the-way places. This work was done very thoroughly, and kept up until May 1st, when it was time for the eggs to hatch. Three or four large shellbark hickories south of Center Street near Whittlesey Avenue were found to be infested with egg-masses, most of them being on the under sides of the loose pieces of bark or "shingles," and discovered only after these were removed from the tree. Two such trees had about 400 egg-clusters on each.

One apple tree on Prince Street contained ninety-seven egg-masses and thirty-seven were found between the old boards of a patched fence on Williams Street. Some of the egg-masses were in singular places. One was found on the shade or cover of an incandescent electric street light, and a hollow branch of a pear tree (shown on Plate XXIII, a) having a crack on one side contained forty-nine egg-masses, one of which was deposited upon the side of a small hornet's nest in the hollow.

In all 8,234 egg-masses were found and destroyed. Mr. Caffrey was continually scouting, not only during the destruction of the egg-masses but throughout the caterpillar season.

In addition to the scouting done by the state men, three Federal scouts were placed in Wallingford February 9th, and later the number was increased to five. These scouts covered the territory under authority from this office granted by the legislature in Section 2, Chapter 114, of the Public Acts of 1907, page 666, which reads as follows:

"The state entomologist shall have authority to suppress and exterminate said gypsy and brown-tail moths, and may employ such assistants and laborers as he deems expedient; may cut and burn brush and worthless trees in fields, pastures, or woodlands, or along the roadsides on any public or private grounds; and may prune, spray, scrape, or fill cavities in any fruit, shade or forest trees, or clean up any rubbish for the purpose of furthering said work. The said state entomologist, or any of his assistants, deputies, agents, or employees, shall have the right, at all times, to enter any public or private grounds in the performance of their duties."

The Federal scouts examined the entire region around the village where our men had not gone over the ground. They spent the entire season scouting, and covered the whole town of Wallingford except in the center of wooded areas; Meriden, both city and town; Berlin; New Britain; New Haven; parts

of Orange, including West Haven; East Haven, Branford and North Haven; and are at the time of this writing scouting around the city of Hartford and the town of Newington, and expect to cover the territory northward on both sides of the river to the Massachusetts line. In all this scouting work no gypsy moth infestation was found outside of the village of Wallingford. Another force of Federal scouts covered a portion of the northeast corner of the state, including the towns of Thompson, Putnam, Pomfret and Woodstock. In all probability the pest will soon spread into this part of the state from the nearby infested territory of Massachusetts and Rhode Island, as is the case with the brown-tail moth, as described on page 683 of this report.

Commencing November 1st, Mr. Caffrey and three men examined the entire infested area in Wallingford, but though a careful search was made, only twenty-three egg-masses could be found.

Pruning and Scraping Trees.

Many vacant lots in Wallingford contain apple trees, some of them being the remnants of old orchards on the land before it was cut up into building lots. Such trees have not been cared for, and at the beginnning of the gypsy moth suppression work were crowded with living and dead branches, cavities and water sprouts. Nearly every back yard also contained one or more fruit trees, and though many of these were in good condition, some had been neglected like those on the vacant lots, and all needed more or less attention. These trees were first pruned, all dead branches were removed, then such living ones as might be necessary to the best growth of the tree and enough to let light and air into its top. All wounds were painted over with dark green or brown paint. A few property owners burned their own brush, but hundreds of loads thus removed had to be disposed of, and most of it was carted to the dump on Whittlesey Avenue and burned after drying slightly. Then all rough loose bark was scraped from the trunks and larger branches, care being taken not to injure the cambium, but leaving no upturned edges of bark under which caterpillars could hide.

Most of the trees thus treated were on private property, and where the owners were not likely to take any action, and in most cases did not know what to do. Few street trees

were pruned in this way by men on the force, but some of the street trees were pruned by men employed by the warden of the borough, Mr. William E. Becroft. Altogether over 900 trees were pruned by men employed by the state in order to make it possible to do effective work in controlling and suppressing the gypsy moth in Wallingford.

Hedge around Cemetery.

The Norway spruce hedge around the cemetery was infested with egg-masses along the Center Street side. The egg-clusters were not only on the trunks and branches, but also on the small twigs, and even on dead leaves in the tops of the trees. The growth of these trees was extremely thick in the tops, which had been sheared each year, and it was impossible to treat the egg-masses without destroying this portion of the hedge.

Many of the trees had died, rendering the hedge unsightly, and as it was close to the street and trolley line and high enough to obscure the view of approaching teams, automobiles and trolley cars at the corner, and as several accidents had occurred, some of the citizens asked us to remove the hedge. A conference was held with the town and borough officials, and it was finally decided to remove the hedge along the Center Street side of the cemetery and for a few feet back on Orchard and Colony streets, so as not to obstruct the view at these corners. On April 18th the hedge was removed for a distance of 875 feet, containing 148 trees. The trees were sawed off close to the ground, lifted upon a wagon and carried to the dump, where they were trimmed. All egg-masses found on the trunks and branches were creosoted and all of the small brush burned.

The hedge on the other three sides of the cemetery (over 2,000 feet and containing 340 trees) had lost its lower branches, making it unsightly. These were cut off, carted away and burned, together with all dead leaves and other rubbish under the hedge. Several loads of tin cans also had to be removed.

It has since been decided by the local authorities to widen the street against the cemetery and to build a wall in place of the hedge.

Covering and Filling Cavities.

Many of the trees that were pruned also needed attention in other directions. Deep or shallow cavities, hollow trunks or

branches and broken and torn limbs all provided hiding places for caterpillars and had to be eliminated before thorough and effective work could be done. Wherever possible all cavities were covered with patches of tin, closely fitted and nailed to the wood and painted dark green or brown, to make them inconspicuous. This is much less expensive than to fill the cavities with cement concrete, but in some cases where the margins were ragged and uneven, or where it was desired to prevent the exit of any caterpillars hatching from undiscovered egg-masses which might possibly be in the cavity, the latter treatment was used. One part of the best Portland cement was mixed with three parts sand and five parts crushed stone, and in large cavities brick or larger stone was used to help fill the opening. Several large and irregular cavities in the street trees on Center Street were filled in this way. These trees were in such shape as to make moth extermination impossible without treatment, and a thorough job was done, partly as an object lesson. Some of the tin patches have been injured by thoughtless or careless persons puncturing holes in them, so that they must be renewed, thus increasing the cost of the work.

In all twenty-seven large cavities were filled with cement and 1,959 were covered with tin patches.

Fences and Walls.

Mention has already been made of an old fence between Williams and Meadow streets which had been patched up with boards from time to time until it scarcely resembled a fence. As this was in the worst infested center in the town, and many egg-masses were found and creosoted on the outside of it, it was necessary to overhaul it in order to destroy the eggs which were almost sure to be found between the boards. This was done on April 15th, and thirty-seven egg-masses were found. The old fence was taken away entirely and a new fence of wire netting built in its place.

On Franklin Street a retaining wall had been built of old railroad ties at the rear of a residence, and close beside it stood one of the large hickory trees which have already been mentioned as being badly infested. This wall made an excellent place for caterpillars to crawl in where they might transform and the eggs be laid entirely out of our reach. We had planned, therefore, to

cover the face of the bank with wire netting and plaster it up with cement mortar to keep out the caterpillars. The owner, hearing of this, wished to build a permanent wall, and asked us to help toward it instead of making temporary repairs which would be of no benefit to him. A sum equal to the cost of the wire and plaster work was therefore paid, and a tight permanent stone wall was built. Some plaster work and pointing up was done on the next lot, making the bank wall safe against further infestation.

Banding Trees with Burlap.

All trees throughout the infested area and in a wide zone around it were banded with burlap during the month of May. This means that all fruit, shade and ornamental trees growing within the area covered by the map shown on page 339 of the report for 1909, and some further southwest and east, were banded. In all, this amounts to about 10,000 trees, and 2,493 yards of burlap were required. The eight-ounce grade was used, and it was purchased cut in eight-inch strips ready to apply. It was fastened to the trees with jute twine, about 102 pounds being used.

Banding Trees with Tanglefoot.

In the most densely infested portion of the area, bands of a sticky substance known as "Tree Tanglefoot" were placed around the trunks to prevent the crawling up of caterpillars, many of which might be expected to hatch from the eggs scattered upon the ground. The Tanglefoot was smeared upon the bark at a convenient height, and served to catch thousands of small caterpillars. This material remained sticky for several weeks, but had to be combed over occasionally to prevent it from becoming hard enough for insects to cross. Tanglefoot was also used on many fence posts, and was placed on a large sheet of paper around the hollow pear limb shown on Plate XXIII, a, and all the caterpillars were caught in it as soon as they hatched and tried to crawl away. Many of these bands had to be renewed. In all 365 trees were thus treated, requiring 120 lbs. of Tree Tanglefoot.

Spraying with Poison.

Most of the trees in the worst infested section were sprayed with arsenate of lead, 5 lbs. in 50 gallons of water. The trees

sprayed were mostly in yards and in the cemetery, though street trees were sprayed on Williams, Orchard, Union and Franklin streets, Whittlesey Avenue and between Main and Elm streets. In fact, they were sprayed in all of the badly infested spots.

The remaining portion of the hedge, nearly half a mile in length, was thoroughly sprayed twice. Hundreds of shrubs, rose bushes, and vines were also sprayed. Most of the spraying work was done by J. Taylor, who was employed with a team for half of each working day. Some hand work was done by the other men, however, as the small wheel outfit enabled them to go into back yards for small jobs without a team. From the dead caterpillars observed on the leaves of small trees in back yards, we know that the poison killed hundreds and probably thousands of them.

Some of the elm trees of the borough were sprayed by the Village Improvement Association, and by property owners to prevent the ravages of the elm leaf beetle. Though this work was not directed against the gypsy moth, it all helped toward controlling that pest.

Over 200 street and back yard trees, exclusive of those in the cemetery hedge and the shrubs and vines, were sprayed by our men, and 768 lbs. of lead arsenate was used.

Destroying Caterpillars.

The men employed to turn bands were supplied with small forceps and small stoppered jars or bottles containing denatured alcohol or gasolene. All caterpillars found were dropped into the liquid and brought to the tool house, each man reporting each day and showing his catch.

The first egg-mass to hatch was one inside the tool house, which commenced hatching on March 30th. The first caterpillars were observed out of doors on April 18th, but they were not found under the burlap bands until May 27th, when they were about an inch long. The most taken in one day was 1,312 on June 14th. The last one was gathered on August 5th, and in all 8,936 caterpillars were destroyed at burlap bands and on the trunks of the trees, exclusive of those killed by spraying and by the Tanglefoot. Some of the caterpillars pupated, and ninety-five cocoons were found and destroyed.

Food Plants of the Caterpillars at Wallingford.

Gypsy caterpillars are known to feed upon nearly six hundred different kinds of plants, yet they have a choice, and when they are able to exercise it they have a much shorter *menu*. At Wallingford they were observed by Mr. Caffrey to feed upon the following trees and plants: Apple, pear, plum, cherry, quince, rose, wild cherry, maple, hickory, chestnut, elm, sycamore, willow, poplar, spruce, larch, grape, wistaria and lettuce.

Natural Enemies.

No natural enemies of the gypsy moth were noticed at Wallingford except in one case, when some caterpillars were gathered and one had twenty-five white Tachinid eggs on its back. This was placed in a separate jar, and after feeding, in due time pupated, but the adult moth never emerged. On September 1st a large two-winged fly appeared in the jar, and this was identified by Mr. C. W. Johnson as *Tachina mella* Walk., a species previously recorded as being parasitic upon the gypsy moth in Massachusetts. The gypsy moth cocoon was closely packed with Tachinid puparia, but no other flies emerged and evidently they could not get out.

Observations.

While working in a tree, one of the men, Mr. R. W. Bolton, observed a gypsy caterpillar crawling along a telephone cable which passed through between the branches of the tree. This method of spreading may account for the caterpillars appearing in certain trees where all egg-masses had been destroyed and a Tanglefoot band placed around the trunk. Telephone wires passed directly from infested trees into these described.

Mr. Caffrey found an unusually large egg-mass on August 22d, which had apparently been laid at one time by one female, and on counting, it was found to contain 1,485 eggs.

The first hatching of eggs was in the tool house on March 30th. Outside the first caterpillars were observed on April 18th and first taken under bands on May 27th. The first pupa was found on June 23d, and the first adult female July 7th.

Tool Houses.

As quarters were needed for storing tools, pumps and supplies, and as a place for the men to report each morning, Mr. Becroft,

warden of the borough, kindly placed at our disposal a basement room under the town hall, which was used throughout the season. This point was central and near the trolley lines. For the storage of poison, pumps, etc., space was allotted us in a large storehouse used by the borough near the steam railroad.

Force Employed.

Except for the first two weeks before Mr. Caffrey took charge, local men were employed. For the scouting and pruning not many men were needed, but in the summer, when there was pruning, cavity work, spraying, turning bands and applying burlap and tanglefoot, more help was necessary, and as many as eighteen men were employed, while the least number working at any time was five.

Cost of the Work.

Up to the end of the calendar year of 1910 the total amount of money expended by the state for the suppression and control of the gypsy moth at Wallingford was $3,823.34. The last General Assembly appropriated the sum of $10,000 for this work for the biennial period ending September 30th, 1911.

A considerable sum has also been expended by the Federal authorities for scouting in this part of the state, but the exact figures are not at hand at the time of this writing.

The work at Wallingford is summarized below, but the figures do not include the thousands of young caterpillars killed by spraying and by the Tanglefoot bands, or the hundreds of trees in the spruce hedge of nearly half a mile in length around the cemetery, all of which were sprayed twice.

SUMMARY OF THE GYPSY MOTH WORK AT WALLINGFORD, 1910.

Egg-masses destroyed	8,234
Trees banded with burlap	10,000
Trees banded with Tanglefoot	365
Trees pruned	904
Cavities filled with cement	27
Cavities covered with tin patches	1,959
Trees sprayed with poison	219
Caterpillars destroyed at burlap bands	8,936
Cocoons destroyed	95
Number of trees found infested	248
Amount of lead arsenate used, lbs.	768

Amount of Tanglefoot used, lbs.	120
" " burlap used, yds.	2,493
Number of men employed—maximum—	18
" " " " —minimum—	5
Cost of state work at Wallingford	$3,823.24

Stonington Infestation.

The work here was in charge of Mr. Horace Niles Trumbull, a student of Union College, who has been employed on the work for two or three seasons under Mr. Hollister. As Mr. Trumbull could not commence work until about the second week in June, he arranged that the banding of the trees should be done by Mr. J. E. Fairbrother, who was familiar with the work on account of having assisted in it in 1909.

As only ninety-eight caterpillars were found in 1909, much the smallest number since the discovery of the infestation in 1906, and as the combined efforts of state and Government scouts revealed but a single egg-mass in December, 1909, it was expected that few, if any, caterpillars would appear in the summer of 1910. But evidently one egg-mass had been overlooked, for during the summer 146 caterpillars were found and destroyed by our men. It was considered necessary at the beginning of the season to band and spray trees, and in fact manage the whole matter exactly as if caterpillars were known to be present, so the banding was done in the usual manner. No caterpillars were found until June 17th, when Mr. Trumbull noticed one feeding on some foliage in the yard of Mr. Koelb of Elm Street. A careful search was made, and over sixty were found and destroyed that afternoon. The grass, raspberry bushes and other vegetation along the wall were cut and burned, and the wall burned out with oil. All other vegetation in the yard was sprayed with lead arsenate. Later a few caterpillars were found at the Stanton place and at Mr. Darrell's, and all the trees and shrubs in the vicinity of those infested on both places were sprayed. The bands were examined for several weeks after any caterpillars were found.

Mr. Trumbull did much scouting for caterpillars outside of the yards infested. As in 1909, no caterpillars were found at Walnut Grove, though all the trees there were banded and a sharp watch was kept for them. The first cocoon was found July 14th.

Brush and weeds were cut and burned in several places, but it was not necessary to do much pruning or cavity work, as this had all been done in previous years. All bands were removed and the work closed on August 20th.

Following is a summary of the season's work at Stonington:

SUMMARY OF THE GYPSY MOTH WORK AT STONINGTON.

Egg-masses destroyed	1
Trees banded with burlap (approx.)	6,500
Trees banded with Tanglefoot	105
Trees sprayed (mostly small) (approx.)	200
Number of trees found infested	20
" " places found infested	5
Caterpillars destroyed	146
Amount of lead arsenate used, lbs.	100
" " Tanglefoot used, lbs.	40
" " oil used, gallons	25
" " burlap used, yds.	1,226
Number of feet of stone wall burned out	900
" " men employed—maximum—	5
" " " " —minimum—	3
Cost of season's work at Stonington	$588.58

The total cost to the state of all suppression work against the gypsy and brown-tail moths and in inspecting imported nursery stock in Connecticut for the past year has been $4,542.27. In addition to this the Federal authorities have expended $4,817.74 in scouting different parts of the state.

THE BROWN-TAIL MOTH IN CONNECTICUT.

In two previous reports of this station (see Reports for 1902, page 165, and for 1907, page 313) as well as in Bulletin 153, page 8, information has been given regarding the brown-tail moth, *Euproctis chrysorrhœa* Linn., but at the time that these publications were issued that insect had not been found in Connecticut, all reports to the contrary notwithstanding. Several newspapers have reported its presence, but whenever the reports were investigated, the insect always proved to be some other species or else the report could not be traced to its source and the responsibility for it fixed. On April 6th, 1910, specimens of nests and dead caterpillars were received from Mr. Richard Barton of Thompson, with the following letter:

Dear Sir:—I am mailing to you under separate cover in a box some caterpillars' nests found near the highway on a pear tree by one of Mr. H. L. Frost's men, who was doing some pruning in this village. He thought it was the brown-tail, and so I took them and carefully cyanided them and sent them to you for identification. I really hope that they are not brown-tails, as we have not yet been troubled with them in this section. However, if you find that they are, if you will kindly let me know at once I will see what I can do to have a search made in the village with a view to stamping them out.

Yours very truly,

RICHARD BARTON.

The insect proved to be the brown-tail moth, and Mr. Barton was notified to that effect. The information came at a time when all the men were very busy, and imported nursery stock was arriving daily, and of course had to be inspected at once. Messrs. Walden and Champlain visited the place on May 4th and hunted for nests and for the work of the caterpillars. Mr. Walden made notes as follows:

"Looked up Mr. Barton, who is manager of the estate of Norman B. Ream. He stated that a Mr. Lynch, foreman for the H. L. Frost Company, found the nests on a pear tree on the place of E. S. Backus, which adjoins the Ream estate. Mr. Barton took us to the place and showed us the tree. The end of a branch for two or three feet showed insect work, and a web not unlike that of the tent caterpillar was seen on the branch, but on examining the caterpillars they were found to be those of the brown-tail moth. Nests were seen on a pear tree near the side of the barn and on two apple trees at the rear of the house. Upon examining trees in near-by yards, nests were found on trees in two yards on the other side of the street. They were found on one tree 400 to 500 feet from where first found. About 12 nests in all were seen.

"Apple, pear and cherry trees were examined on the road towards Rhode Island for about one-third of a mile, and no nests were found. We examined the trees on the road towards Massachusetts for about a mile. Apple trees were generally well covered with blossoms, and other trees were coming into leaf, so that it was rather difficult to find nests.

"On May 10th, went up to Thompson and sprayed the trees where brown-tail moth nests were found. Used 13 lbs. Swift's lead arsenate, 6½ lbs. to the barrel (about 50 gallons). Mr.

Barton furnished two men, pump and team to do the work. It was very windy, but the trees were sprayed as thoroughly as possible under the conditions."

About a month later, two nearly full-grown dead caterpillars were received from Professor George H. Lamson, Jr., of the Agricultural College at Storrs. These were handed to him by Mr. J. H. Osgood, who found them feeding upon fruit trees at Putnam. On June 15th Mr. Walden visited Putnam and met Mr. Osgood, who boarded at Mr. E. Williams', 157 Elm Street, where he found the caterpillars on trees in the yard. Mr. Osgood had previously sent some of the nests to a Willimantic paper. He showed Mr. Walden around the place where he had observed the insect and its work. A pear tree in the yard of Mrs. Thurber, at 143 Elm Street, was nearly defoliated, and is shown on Plate XXXI, b. Two pear trees in a yard on the corner of Buck Street and three or four blocks west of Elm Street, were found infested, and a pear tree near a blacksmith's shop just west of Elm Street showed the work of the caterpillars. On School Street, east of the railroad and some distance from Elm Street, the work of the insect was apparent in two yards. In two other yards on the same street pears and apples were found infested. Mr. Walden made an effort to learn the extent of the territory infested rather than to discover all of the infested trees within that area.

At this time most of the caterpillars had pupated, so that spraying was not attempted.

In November, Mr. D. M. Rogers, special field agent of the Bureau of Entomology, in charge of preventing the spread of the gypsy and brown-tail moths, wrote that his men, who had been scouting Thompson, Putnam and Pomfret, found brown-tail nests in Thompson and Putnam, and at the latter place the nests were rather abundant on fruit trees in the yards about the town.

These infestations in Thompson and Putnam are probably on the edge of the area generally infested, which has nearly reached Connecticut for two years in both Massachusetts and Rhode Island. Mr. Rogers reports that his scouts have also found the pest at Wilbraham, Mass., which is just east of Springfield, and of course the infestation may extend all the way to Putnam. During the winter much scouting will be done in this locality,

and all nests found will be destroyed. It is hoped also that scouting may be done along the state line from Thompson westward to the Connecticut River and southward to the Sound. Though it will be impossible to eradicate the brown-tail moth, as can be done with isolated colonies of the gypsy moth, the former can be more readily controlled, and is not such a serious pest of vegetation as the latter, though very troublesome to humans on account of the poisonous and irritating hairs that break off from the caterpillars and adults.

As this insect is now present in Connecticut, a description of its different stages and its injury is given here, so that people may recognize it.

The Adult Moths.

Both sexes have the same color and markings, but the male is smaller than the female and has a more slender abdomen. Both pairs of wings are pure white, as is the thorax and a part of the abdomen, but the rear end of the body bears a tuft of

Fig. 10. Female Brown-tail Moth, natural size.

brown hairs which are rubbed off from the female in the process of egg-laying and incorporated with the eggs, and give the egg-cluster a reddish brown color. The female has a wing expanse of one and one-half inches, while that of the male is somewhat less, perhaps one and one-fourth inches. The male has feather-shaped antennæ, tinged with brown, and the forewings are edged with brown on the under side. The female has wings that are white on both sides, and the antennæ are white and much smaller than those of the male.

Both sexes fly, and fairly swarm around electric lights in a badly infested section at the time of their emergence in July. On account of the ability of the females to fly, it is difficult to exterminate an isolated colony. Sometimes, if there is a

storm during the flight of the moths, they are driven with the wind long distances. Many dead moths are found in the globes of the arc lights. The female is shown in Fig. 10.

The Egg Stage.

The eggs are usually laid in oval clusters of from 200 to 400 eggs each, and on the under side of a leaf. The eggs are laid the first three weeks of July, and the masses are reddish

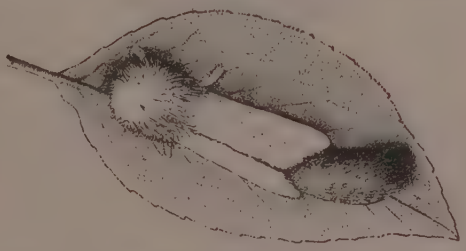

Fig. 11. Egg-mass as laid on leaf by brown-tail moth, natural size.

brown from the hairs of the female moth, and about three-fourths of an inch long. The eggs are spherical, and yellow in color. They hatch in from fifteen to twenty days after being deposited. The appearance of the egg-mass is shown in Fig. 11.

The Caterpillar.

The young caterpillars, after hatching from the eggs late in July or early in August, feed at first on the leaf containing the

Fig. 12. Winter nest of brown-tail caterpillars, natural size.

egg-mass, but later other leaves are devoured. In September a number of leaves are drawn together and fastened and lined with the silk spun by the caterpillars, making a nest (see Fig. 12) in which the larvæ spend the winter, a hundred or more sometimes living in one nest. The larvæ emerge in spring and feed upon the leaves which first appear, and continue to devour

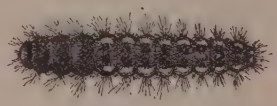

FIG. 13. Brown-tail caterpillar, natural size.

the foliage, increasing in size and molting four or five times until fully grown, and they are about an inch and one-half long when they spin their cocoons about the 20th of June.

The caterpillar is dark brown in color, with light brown hairs. On each side, so that it shows both dorsally and laterally, there is a row of white tufts, one on each segment, and appearing as an interrupted white band when seen from above. On each of the ninth and tenth segments there is a small red tubercle bearing hairs. (See Fig 13.)

THE COCOON.

The cocoon is usually made between folded leaves or in the crevices of the bark or some other sheltered place and is shown in Fig. 14. The pupæ are commonly found in masses more or less

FIG. 14. Cocoon of Brown-tail Moth, natural size.

loosely held together by the silken webs and hairs from the caterpillars. This stage lasts about twenty days, depending somewhat upon the weather conditions.

Methods of Controlling the Brown-tail Moth.

The gypsy moth eggs, after being deposited, remain for about nine months before hatching, and this is much the longest period of any stage of the insect's existence. But with the brown-tail moth the egg state lasts only between two and three weeks, and the larva or caterpillar stage is the long period, during which the important control work must be done. Caterpillars occur on infested trees from August 1st until the latter part of the following June. Control measures are chiefly of two kinds—destroying the winter nests, and spraying the foliage with poison to kill the caterpillars.

Scouting for winter nests should be done when the trees are bare, and any kind of tree pruner with a long handle is advised. The nests are nearly always at the extremities of the twigs, and can be readily seen during the winter months. As they are clipped from the trees they should be gathered and burned. If left on the ground, the caterpillars inside them may keep alive and crawl upon the trees when warm weather comes in the spring.

After the leaves appear, the caterpillars are no longer found in the nests, and the only way of destroying them is to spray the foliage with poison. For this purpose lead arsenate should be used at the rate of 3 lbs. in 50 gallons of water for the young caterpillars, but 5 lbs. should be used against those nearly full-grown.

Natural Enemies.

The most important natural enemy of the brown-tail moth is a fungus, *Empusa aulicæ*, which in certain moist seasons destroys a large proportion of the caterpillars, which may be found dead on the trunks of trees and the stones of buildings and walls. Sometimes large numbers die in their nests. There are a number of native insect enemies and parasites of the brown-tail moth, besides several imported ones, which it is hoped may in time check this insect.

TESTS OF PROPRIETARY INSECTICIDES IN DESTROYING THE ROSY APPLE APHIS AND THE SAN JOSÉ SCALE.

By B. H. Walden.

The Rosy Apple Aphis.

Meriden Experiments. This orchard contained about one hundred and twenty bearing apple trees, and during the season of 1909 the rosy aphis caused considerable injury to the fruit. During the fall many aphid eggs were deposited on the fruit spurs and small twigs, indicating that the pest would again be present during the season of 1910. Plans were made to try late spring spraying to control the aphids. Word was received from the owner, March 30th, that the eggs were hatching, and on the following day spraying was commenced. Four rows of the trees were sprayed with Grasselli's lime and sulphur, 1 gal. to 11 gals. of water. The next two rows were sprayed with "One for All," 12 lbs. to 50 galls. water. On April 6th the remaining two rows were sprayed with Pratt's "Carboleine," 1 gal. to 8 galls. of water. The spraying was done as thoroughly as possible, using a large pump with the pressure averaging about 125 pounds.

The trees which were sprayed the week before were examined, and while many dead aphids were found, others were alive even on buds that were thoroughly coated with the lime and sulphur. Conditions were about the same where the "One for All" was used, though it was harder to tell if the twigs had been as thoroughly coated as those sprayed with the lime and sulphur.

As the season advanced the aphids disappeared from apple trees so that no final conclusions could be reached regarding the treatment.

Station Experiments. During the fall of 1910, eggs of the rosy aphis were observed on the small apple trees at the station. Rarely more than six or eight eggs were found on a twig, but from past experience, even where such small numbers have been present on the twigs of bearing trees, the aphids upon hatching will multiply sufficiently in a season favorable to their development to seriously check the growth of the fruit. The eggs were in crevices around the fruit spurs, or the buds and base of branches on the previous season's growth.

On November 30th eighteen of these trees were thoroughly sprayed with Niagara lime and sulphur, one part in eight parts of water, to note the effect on the eggs. Certain twigs were tagged where the eggs were most abundant. Some of these twigs, which were still well coated with the spray, were examined the first week in January. Most of the eggs were apparently alive, showing no effect from the treatment, although it will be necessary to examine the eggs at hatching time to learn the efficiency of the treatment.

San José Scale.

Meriden Experiments. In connection with the experiments against the rosy aphis in the Meriden orchard, the effect on the scale was also observed. This orchard had been sprayed in previous seasons to kill the scale, and while it was present, only a few trees toward the lower end of the orchard showed much scale in the spring of 1910.

The orchard was visited on November 15th and the effect of the treatment on the scale was noted. Very little living scale could be found on the trees sprayed with the lime and sulphur, and while there was less scale on these trees in the spring, considerable dead scale could be found at the time of examination.

Trees sprayed with "One for All" showed the most living scales. Two of these trees, which must have been well coated in the spring, had branches encrusted with them. The scales were present on the petioles of the leaves, and were noticed on the fruit at picking time.

Many living scales were found on the trees sprayed with "Carboleine," which was rather surprising, as the mixture was used much less dilute than is generally recommended.

A young orchard of apple and peach trees adjoining the one in which our experiments were conducted was sprayed with Grasselli's lime and sulphur during the later part of March. Here many of the trees were quite badly infested with scale, but in November very few living scales were seen.

Station Experiments. Five preparations were applied on April 13th to a block of small trees on the station grounds to note the effect on the San José scale. The trees, principally apple and peach, and moderately infested with scale, were set rather closely in rows about four feet apart. A screen was used to prevent the spray from blowing upon adjacent trees treated with different

preparations. The buds were opening and a few leaves were out when the applications were made.

Grasselli's Lime and Sulphur. Used at the rate of 1 gal. to 11 gals. of water: Eighty-two trees were sprayed. No injury to the opening buds. No living scales on twigs examined June 30th.

Crowley's "Arbolineum." Used 1 part to 8 parts of water. Considerable injury to buds and young leaves showed the following day. No living scales on twigs examined June 30th. The trees showed the effect of injury throughout the season.

"One for All." Used at the rate of 12 lbs. in 50 gals. water. No injury to buds followed the treatment: 2.2 per cent. of living scales were found on twigs when examined June 30th.

Vreeland's Scale-Killing Compound. As no directions were given with this preparation, it was used at the rate of 1 gal. in 8 gals. water. Warm water was used, as it did not mix readily with cold water. This preparation did not injure the buds. When twigs were examined June 30th, 17.4 per cent. of the scales were found to be alive.

Bogart's Sulphur Compound was used 1 part to 15 parts of water. There was no injury to buds, but 2.7 per cent of the scales were found to be alive when the twigs were examined June 30th.

On November 30th, twenty-eight of the small apple trees were sprayed to kill the scale with Niagara lime and sulphur, 1 part in 8 parts of water. An examination of the scales February 28th showed 2.6 per cent. of the scales alive.

EXPERIMENTS ON STATION TREES, APRIL 13, 1910.

Kind of trees.	Number of trees treated.	Condition of trees before treatment.	Materials applied.	Percentage of Scales alive after treatment.
Apple	69	Moderately infested	1 gal. Grasselli's Lime Sulphur 11 gals. water.	0.%
Peach	13	" "		
Apple	22	" "	1 gal. Crowley's "Arbolineum" 8 gals. water.	0.%
Peach	14	" "		
Apple	37	" "	1 lb. "One for All." 4 gals. water.	2.2%
Peach	9	" "		
Apple	60	" "	1 gal. Vreeland's Scale Killing Compound 8 gals. water.	17.4%
Peach	13	" "		
Apple	78	" "	1 gal. Bogart's Sulphur Compound 15 gals. water.	2.7%
Peach	12	" "		
Total	327			

A PHORID (*Aphiochæta rufipes* Meigen) INFESTING ONION SEED.

By B. H. Walden.

Specimens of a small maggot from the seed-testing department were brought into the laboratory on October 28th for determination. These were taken from onion seeds which had been put in the germinator to test their vitality. The maggots were first observed in three or four days, or soon after the seeds had begun to sprout. They soon ate out the interior of the seeds and were present in such numbers that it was impossible to obtain any data regarding the vitality of the seeds. Spinach and grass seeds which were in the germinator were not attacked, so the first supposition was that the onion seeds were infested when put in to test.

A re-test was made from the same lots of seeds (seven in number) and no maggots were found in these. A third test showed no infestation, which seemed to contradict the idea of the seed being infested before being placed in the germinator. The one in charge of the seed testing had not observed any similar insects in seeds before.

An examination of the germinator showed a chance for small insects to readily enter it through the slide provided for ventilation, and which was often open. Even the large door of the germinator was sometimes left open to lower the temperature.

All of the infested material was removed in the blotters to the entomological laboratory and placed under a bell-jar with the moisture and temperature regulated as far as possible to correspond with that of the germinator. The seeds and blotters were carefully examined to find the egg of the insect. One small oval white egg was found on a seed, and two similar eggs were found on the blotters. As these did not hatch it was not proven that these were the eggs of the insect.

In about ten days from the time the seeds were first placed in the germinator a number of the larvæ pupated.

The first adult emerged November 21st, twenty-four days after the pupæ were first observed, and proved to be a small two-winged fly, *Aphiochæta rufipes* Meigen. This insect belongs to the family Phoridæ, a group of flies, the larvæ of which infest decaying vegetable and animal matter, such as fungi, insect

cocoons, dead caterpillars and snails, exhumed human bodies, etc. These flies are readily recognized, being quite small and very active. Many of them have the "hump-backed" appearance shown in the drawing representing this species, Fig. 15. The Phoridæ are separated by the peculiar wing venation and shape

FIG. 15. Adult male of *A. rufipes*, enlarged.

of the antennæ. The above species is one of the more common and widely distributed species and is a very general feeder.

With the temperature of the germinator at about 86 degrees F. throughout the day and the excessive amount of moisture needed to start germination, caused the onion seed to give off an odor which would naturally attract insects of this nature. Seeds with no such fetid odor would naturally escape infestation by this insect. A number of these flies must have been present at the time the first lot of seed was placed in the germinator. After depositing eggs, the adults probably all died before the next lot of seed was started.

It was not learned how the insect was brought into the place though there was considerable dried vegetable matter in the laboratory, quantities of seeds, sacks with dried alfalfa hay, etc.

Egg. The egg found on the onion seed was shiny white in color, of an oval shape, tapering gradually toward the ends. Length .53 mm., width .019 mm.

Larva. General color, white, apparently caused by the fatty tissues seen through the transparent skin. Lateral edges nearly transparent. Length 3.79 mm., greatest width 1.017 mm., tapering toward either end, narrowing most toward the front. The segments not well defined, excepting when the larva crawls.

The first segment with two pairs of nearly equal, pointed tubercles which appear to be two-jointed. A lateral tubercle present on this and all other segments. Last segment with four tubercles corresponding to those on the first segment, the central pair smaller than the ones on either side. The second and third seg-

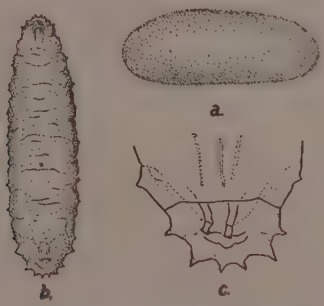

FIG 16. *Aphiochæta rufipes.* a, egg. b, larva. c, posterior extremity of larva.

ments with four small dorsal tubercles near their front margins. On the second segment back of the four tubercles is a pair of slender nearly black tubercles. The last segment is provided near its base with a pair of large, blunt, yellowish tubercles.

Pupa. Yellowish, changing to a dull brown color. About a week before the adult emerges the legs, antennæ, etc., can be

FIG. 17. Dorsal and lateral view of pupa of *A. rufipes* enlarged.

seen through the pupa skin. Length 3.17 mm., width 1.149 mm. The widest portion is at the apical fourth, from which it tapers sharply toward the apex, this part forming a triangle. It is narrowed much more gradually toward the rear with the anal end rounded, the four anal tubercles being well defined. The sides are depressed dorsally, forming a sharp margin. The thorax is

provided with a pair of long slender black processes, corresponding to the pair of slender blackish tubercles, on the second segment of the larva. Laterally the pupa tapers more sharply toward the apex than it does toward the anal end. The general dorsal profile is more curved or bent than that of the ventral surface.

Adult. The head, antennæ, thorax and abdomen are black, the upper surface of male with conspicuous brownish black bristles which are absent on the abdomen of the female. The legs vary from brownish to reddish yellow. The wings are transparent, with very long bristles on the costal vein (the upper edge). Length 2.5–3 mm.

The species is widely distributed throughout the United States.

Remedies. Such an infestation could probably be prevented by having a fine wire cloth screen over the ventilator of the germinator. Material in which the insect is liable to breed should not be stored near the germinator.

A PYRALID CATERPILLAR ON NURSERY STOCK FROM JAPAN.

Hemiscopis cinerea Warren.

During the season of inspecting imported nursery stock on April 12th Mr. Walden found in a shipment of ornamental shrubbery from Japan some caterpillars on a deciduous shrub resembling lilac. All specimens that could be found were placed in a tight jar and carried to the laboratory for study. As they were nearly full-grown, they pupated in a short time. About June 10th the adults began to emerge, and in a week or so eight specimens had appeared. On November 4th one of these was sent to W. D. Kearfott for identification, and he replied in part as follows: "Your letter of the 4th with specimen of Japanese Pyralid safely received, and I have examined all of my literature trying to find the name of it and without success, and will have to send it to London for determination. The specimen is a female. Will you please look through any others you may have and see if you can find a male? If you will forward the male, I will send it over to Hampson, and he is usually very prompt in replying, so that you can expect action within a month."

Additional specimens were sent to Mr. Kearfott on November 21st. He acknowledged them, and sent a pair to Sir George Hampson. A month later Mr. Kearfott wrote: "I have just heard from the British Museum and secured the name of the Pyralid bred from Japanese nursery stock, which in your letter of November 4th you stated was lilac or some closely allied deciduous stock. The species is *Hemiscopis cinerea* Warren, belonging in the sub-family Pyraustinæ. This species was described in the Annals and Magazine of Natural History, Series 6, Volume IX, page 396, from Japan. It is referred to (by name only) by Hampson in Proceedings Zoölogical Society of London, page 223, 1889."

The following brief descriptions were drawn from the material studied in our laboratory.

Larva. About three-fourths of an inch long, one-tenth of an inch thick. Ground color cream or white, with a light salmon-pink spiracular stripe. Head light chestnut brown, shiny. Thoracic shield, legs, jaws and tubercles dark seal brown, shiny. Thoracic shield divided dorsally by a longitudinal whitish band or a continuation of the body color. The brown tubercles are arranged as follows: four rows show dorsally and the same number laterally, two above and two below the pinkish stripe. A bristle or hair is borne on each of the dorsal tubercles. Shown in Fig. 18.

Pupa. About seven-sixteenths of an inch long, about one-eighth inch thick. Color light brown. Enclosed in case of

FIG. 18. *Hemiscopis cinerea*, dorsal and lateral view of larva, four times enlarged, and face of same, greatly enlarged.

particles of Sphagnum used for packing, and fastened together and lined with silk.

Adult. Wing-spread from seven-eighths to one inch. Color brownish, somewhat darker in the female, with a violet iridescence on upper surface of both wings: a darker V-shaped mark

extending across both front and rear wing, as shown on Plate XXIX, c. Under surface unicolorous; t-p line and discal spot showing. Legs brown except tibiæ, which are covered with whitish scales. Head and body brown above. Under side of head and fourth, fifth and sixth abdominal segments bearing whitish hairs on the ventral side.

Letters were written to the Bureau of Entomology at Washington to learn whether or not this insect is regarded as a pest in Japan, but it seems not to have been mentioned in the accessible literature except the references given above. I have also written to Professor S. I. Kuwana of Tokyo, who states that *Hemiscopis cinerea* is rather uncommon in Japan, and that so far nothing is known about its life history and that it is not considered a pest there.

CARTRIDGE SHELLS RUINED IN TEXAS BY ANTS.

On February 23d, 1910, a box of paper shotgun cartridges which had been eaten apparently by insects, was sent to the station for examination and study by a manufacturer of cartridges, accompanied by the following statement: "These were returned by a customer in Texas. We do not know how long they had been in his possession, but they were loaded and shipped by us about November, 1906. Any information which you can give us in regard to the damage to these goods would be very much appreciated, and if there is any further information which we can supply you with to assist you in your investigations, please call upon us."

The cardboard shells, and in some cases the wads, had been eaten so that the powder and shot fell out and mixed together. From the appearance of the goods, some being badly eaten and others nearly perfect, it was evident that the insect had used the box of shells as a nesting-place rather than as a source of food.

One of the shells is shown on Plate XXIII, c.

After examining the injured material, the following letter was sent to the manufacturers in reply:

> The samples of cartridges submitted by you, and showing the injury by some kind of insects, have been examined, and the letter of Feb. 23d was also received.
>
> I have gone over the injured cartridges with considerable care, and, from what I know about the injuries to some other articles by various kinds of

insects, and from their appearance, I suspected at the start that it was caused by some kind of ants.

For instance, on each cartridge one can see where the ants have crawled up and down, having regular run-ways, corresponding to the interstices between the cartridges as packed in the boxes. A very careful examination of the debris gave me a portion of the rear wing of some kind of an ant, and also in another place I found an ant's head. These, of course, do not enable me to identify the species, but merely serve to show that the box has been infested by ants.

A few years ago a new kind of ant appeared in the vicinity of New Orleans, and caused great damage to all kinds of stored food products, as well as other articles of commerce. This ant has the peculiar habit of making its nest in almost any kind of material. In one case on record, a nest was found between the metal oil can and its wooden jacket. The ants therefore have used this box of cartridges as a nesting place, and the injury was not done on account of the food which they expected to obtain. At least this is my interpretation of it.

This particular species of ant which I refer to as being introduced around New Orleans is called the Argentine ant, and its scientific name is *Iridomyrmex humilis* Mayr. It is supposed to have been brought in some way in ship loads of coffee from South America, and has spread over the southern half of Louisiana, and no doubt has gone into Texas.

Of course I am not certain that this particular kind of ant did the injury, but it is very probable, and in case you wish to read up about the history and habits of this depredator, we have plenty of literature regarding it in our laboratory.

Since writing the above letter I have looked up the published articles on the Argentine ant to learn of its distribution. I have no knowledge that the species actually occurs in the state of Texas, yet it was reported by Newell* as being near the Louisiana-Texas line in 1908, having spread westward from New Orleans, where it was first seen in this country by Mr. Foster in 1891, and reported in literature by Titus in 1904.† It is entirely probable that the pest is now present in some parts of Texas, as its spread is liable to be rapid, especially if shipped with infested goods along the lines of the railroad. On the other hand, the cartridges may have been stored in Louisiana and have become slightly infested before they were shipped to Texas.

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* *Journal Economic Entomology*, i, 21.

† Bureau of Entomology, Bull. 52, 79.

THE LEAF BLISTER MITE.

Eriophyes pyri Nal.

This pest is not an insect, but is a small animal belonging to the Arachnida, the same class containing the spiders. It is commonly known as the pear leaf blister mite, and forms small blisters or galls on the under sides of pear leaves in early summer. In bad cases the blisters are not wholly confined to the leaves, but sometimes occur on the soft twig-growth and on the fruit. At first the blisters are light green, but they soon turn red, and later brown, as the cell tissue dies in these spots. Where abundant, the injury causes the leaves to drop. This mite has long been known as a pest of pear, but only recently has it been recognized as an important apple pest on account of the serious injury which it has caused in the state of New York. It has there been studied by Professor P. J. Parrott, entomologist of the Agricultural Experiment Station at Geneva, who has found several other species causing similar blisters, and has described one of these as new. But none of these species do as much harm as *E. pyri*, and the practical orchardist need not consider them at all, as the method of controlling the pear leaf blister mite will also keep them in proper check.

During the past summer the work of this mite on apple was noticed on several trees in the orchard of E. M. Ives at Meriden, and Mr. Walden states that he saw it there in 1909. It has been sent to the station during the summer (on apple) from Litchfield, New Britain and Ellington. A sample was also received from Cummington, Mass., and from what the writer saw of it in western Massachusetts in August, it seems to be capable of considerable injury, as certain trees had lost at least one-third and possibly one-half of their leaves because of it. Much damage has been done by it in New York state, and it has caused more or less injury in Massachusetts, Pennsylvania, Illinois and Ontario, Canada. In New York state especially, the damage has increased to such an extent that for the past few years no insect attacking the apple, except the San José scale, has attracted more attention or provoked more discussion among growers than has the leaf blister mite. See Plate XXIII, b.

The mite passes the winter under the bud scales, and the most favorable times to reach it by spraying are in late fall after the

leaves drop and in early spring before they appear. Professor Parrott's investigations regarding treatment were extensive, and were conducted in eleven different orchards. He found that the mites could be killed by spraying at the times mentioned above, either with a lime-sulphur mixture or with a miscible oil, but with the many excellent commercial lime-sulphur mixtures on the market, he prefers one of them to other forms of treatment. It will be seen that where this treatment is given to destroy the San José scale, it will answer for the leaf blister mite as well, and if on pear trees, the pear psylla will also be controlled.

A PEST OF BIRCH TREES IN CONNECTICUT.

Bucculatrix canadensisella Chamb.

Everyone traveling by steam or trolley cars in Connecticut during the months of August and September, 1910, has probably noticed the widespread defoliation of the slender white, grey, or bobbin birches (*Betula populifolia*) throughout the eastern part of the state. Especially was this devastation noticeable in Tolland and Windham counties, and I am told that it extended far into Rhode Island and Massachusetts. In the northern part of New London County, and especially around Norwich, this trouble was observed early in September. Over much of this area nearly every tree was stripped of leaves, and in some cases acres and acres of brush land presented a denuded appearance. In riding from Willimantic to New Haven via Hartford the trouble was not very noticeable south of Hartford, though trees here and there were attacked. The writer observed it at New Canaan and around New Haven, where an occasional tree was attacked and perhaps partially stripped, but most of the trees were uninfested. Messrs. Walden and Champlain observed the trouble at Cromwell and at Stratford.

The insect responsible for this condition of the trees is a small moth of the family *Tineidæ* called the birch bucculatrix, or birch leaf skeletonizer, *Bucculatrix canadensisella* Chamb. It is closely related to the apple bucculatrix or ribbed cocoon-maker of the apple, *B. pomifoliella* Clem.

The adult moth is brown, prettily marked with white, as shown in Fig. 19, and has a wing expanse of about three-eighths of an inch. The following description is by Dr. James Fletcher:

"Moth small, wings expanding ⅜ of an inch. General color, bright brown, the wings crossed with silvery white bars; three of these run from the outer edge about half way across the wings obliquely towards the apex, and there two shorter subtriangular blotches on the inner margin of each forewing. These latter, when the wings are closed, form two white dorsal saddles, the anterior of which is slightly the larger, and is followed closely by a tuft of raised black scales. At the extremities of

FIG. 19. *Bucculatrix canadensisella*, adult moth, greatly enlarged. (Redrawn from Packard, Insect Life, Vol. V, p. 14.)

the forewings are also several raised black scales, a few of which are separated into an apical spot by an irregular narrow white band. The cilia of the fringes are pale brown, head white; frontal tuft dark brown in the center; antennæ brown, slender, about ⅛ of an inch long. Thorax brown with margins, including the bases of the forewings, white. Legs and body pale fuscous, silvery."

Little appears to be known about the life history and habits of this insect, and no description of the egg could be found in its literature, though Dr. Felt mentions* the mining operations of the larvæ, which he states have not been observed. At the time the insects were feeding upon the trees I supposed that the species had been more carefully studied, and as we were busy, I neglected to make descriptions of the larval stages, though material was abundant. The caterpillars are only about a quarter of an inch long when fully grown. They are greenish yellow and feed upon both sides of the leaf, eating away the soft green tissue or parenchyma, leaving only the skeleton, which turns brown, and the leaf falls prematurely. There are many small circular whitish cocoon-like objects on both sides of the leaves. These are called pseudo or false cocoons, or molting cocoons, and serve as shelters during the molting period. The larva suspends itself by a thread when disturbed. The following description of the larva is taken from Packard's article in *Insect Life*:†

* Insects Affecting Park and Woodland Trees, p. 315.

† *Insect Life*, v, 14.

"*Larva.* Length 5 or 6 mm. The head is about two-thirds as wide as the body where thickest; it is pale honey-yellow. The body is long and slender, tapering regularly towards each extremity; the anal legs are rather large, project well behind the body, and diverge in creeping. The body is pale honey-yellow, with sometimes a slight greenish hue. The hairs are fine, scattered, arising from small pale warts; besides the four dorsal warts, which are arranged in a regular trapezoid, there is a lateral one visible on each side. The surface of the prothoracic segment is large and broad, though not so wide as the second thoracic segment; about six hairs project from the front edge. The segments are all very distinct, the sutures being deeply impressed, while the hinder edge of each segment is slightly raised and thickened. The second and third thoracic segments are much shorter than the prothoracic, while the first and seventh abdominal segments are longer, at least two-thirds, than the eighth. The ninth abdominal segment is much narrower than the eighth, and narrows posteriorly. There are four pairs of middle abdominal legs, and they are of the same color as the body. The oval cylindrical yellowish testes(?) are distinctly visible under the skin of the fifth abdominal segment."

FIG. 20. Dorsal and lateral view of pupa of *Buccalatrix canadensisella*, five times enlarged.

The true cocoon (shown in Fig. 20) is about one-eighth of an inch long and nearly one-third as broad as long. The shape is that of a flattened cylinder with the ends curved downward, the surface being corrugated or ribbed. The number of ridges in our specimens varies from six in most cases to even eight in others. The cocoons are made on the birch leaves, though Packard records finding them on the leaves of wild cherry.*

The birch bucculatrix was noticed injuring yellow birches in New York state in 1886, and again in 1891. In Canada, and in Massachusetts and Rhode Island from 1890 to 1892, it did considerable damage to grey, paper and yellow birches. Felt† states that it was very abundant in New York state in 1901, and skele-

* *Insect Life*, v, 15.

† Insects Affecting Park and Woodland Trees, p. 315.

tonized the leaves of birches over large areas. The writer obeserved the work of this insect in New Hampshire on yellow birch, probably nine or ten years ago, but in his residence of nearly seventeen years in Connecticut, never before has he seen such an outbreak. According to Mr. Caffrey, some of the birches around Amherst, Mass., were stripped in 1909. Mr. Thompson writes* that this insect was observed in 1910 on birches throughout Rhode Island and eastern Massachusetts as far west as Springfield and north to Manchester, N. H., and to about twelve miles west of Nashua, N. H. It was also reported from Maine, at Waterville, and as far east as Augusta.

I have received several inquiries regarding the probable effect of this attack upon the trees. A single defoliation, coming as it does so late in the season, would not seriously affect the trees, but if continued each year for several years, might kill them. However, if some of these native grey birches should die from the attacks of this insect, the farmer would no doubt consider it more of a blessing than a curse. But as it does not confine its attacks to this species, considerable damage might be done to the other birches, some of which are valuable for timber and for fuel. Cut-leaf and other birches planted for shade and for ornament should be sprayed next year in July with lead arsenate, 3 lbs. in 50 gallons of water, to forestall further injury.

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THE 15-SPOTTED LADY BEETLE.

Anatis 15-punctata Oliv.

The 15-spotted lady beetle was unusually abundant in 1910, especially on apple trees. In one orchard in the town of Orange the writer noticed from fifteen to twenty yellow clusters, containing altogether several hundred eggs, on nearly every tree. Similar conditions were also observed in Meriden and other places. In 1909 the writer found this lady beetle abundant in New

FIG. 21. The 15-spotted Lady Beetle in all its stages, enlarged about four times.

Canaan, where it was apparently feeding upon the aphids (probably *Callipterus betulæcolens*) on a cut-leaf white birch on private grounds. The rosy apple aphis was extremely abundant in apple orchards in 1909 and comparatively scarce in 1910, and it is probable that the 15-spotted lady beetle played no unimportant part in checking this destructive plant louse. The eggs are laid in clusters of ten or twelve, usually on the under side of the large branches of the tree. They are light yellow, and are oval in shape. The larva is very active, and crawls about on the bark and over the leaves, catching and devouring the plant lice. It is larger and darker in color than most lady beetle larvæ. In fact, it is nearly black, save for a fine whitish line extending longitudinally over the back of the thorax, and a broad lighter stripe running along each side of the body. Each segment bears a row

of rather short, stout spines. The pupa is fastened by its posterior extremity to the bark or to the surface of a leaf, and is at first a cream color, marked with brown spots, but soon becomes darker. The adult beetle is about three-fourths of an inch long, and at first is a light reddish yellow, marked with nearly circular black spots. There are eight of these spots on each wing cover, but those on the inner margin at the base are often confluent, and appear as a single spot, hence the name. The thorax has a black patch with two light spots near the base of the wing covers, and a broad light margin bearing laterally two irregular black spots. As time goes on, after the beetle emerges from the cocoon, it gradually grows darker until the spots become very indistinct. Some of the specimens in the station collection appear to be a uniform dark brown color, though if examined carefully the spots may be discerned. The appearance of the egg, larval, pupal and adult stages may be seen in Fig. 21.

This lady beetle is very beneficial and should not be destroyed. Like most of the related species native to Connecticut, it feeds in both the larval and adult stages upon plant lice or aphids. Only one lady beetle found in the state is injurious, and that feeds upon squash vines. All the others should be encouraged rather than destroyed.

BRIEF NOTES.

Cabbage Looper. *Autographa* (*Plusia*) *brassicæ* Riley. This insect has been rather common for two seasons, and in some fields has actually caused more damage than the imported cabbage worm *Pontia rapæ* Linn., from which it can be distinguished by its lighter green color, smooth skin, and body tapering toward the head. It also "loops" or "measures" when it crawls, like the larvæ of the Geometridæ, because there are no prolegs on the sixth and seventh abdominal segments. The caterpillars often attack other vegetables, including celery, parsley, cauliflower, turnip, lettuce, dandelion and tomato, and sometimes get into greenhouses late in the fall and damage plants by devouring portions of them.

The caterpillar is from one to one and three-eighths inches long, and in color is light green, indistinctly striped with white. The adult is a dark brownish grey moth, having a wing expanse of about one and one-half inches, with a silver dot and U-shaped mark near the middle of each forewing.

There are two broods each year, and damage in the cabbage field may be prevented by spraying the plants with lead arsenate, 3 lbs. in 50 gallons of water, as for the imported or common cabbage worm.

Fig. 22. Cabbage Looper, *A. brassicae*, showing adult, larva, and pupa stages, natural size. (After Chittenden, Bureau of Entomology, Bull. 33, U. S. D. A.)

Cottonwood Leaf Beetle. *Lina scripta* Fabr. This beetle is quite a pest in certain regions of New York and other states where basket-willows are grown, and for many years it has been known as a serious enemy of cottonwood in the Middle and Western states. Until the past season we have never taken it in Connecticut, nor had it reported as occurring here. While inspecting nurseries in September, Messrs. Walden and Champlain found this insect quite abundant at Stratford and at Buckland, feeding on Carolina poplar. At the latter place all stages were observed, though the pupæ were much the most abundant. Nearly all of the Carolina poplar trees in the nurseries at these two places were infested by this insect.

Mr. Champlain also found another species, *Lina interrupta* Fabr. (*lapponica* Linn.), very abundant and feeding upon alders at Lyme in May. Both of these species taken in the state during 1910 were not previously represented in the collection, and had

not been reported to this office as occurring in the state. Either may at times injure ornamental trees and shrubs, but probably will not cause widespread damage. Spraying the foliage with lead arsenate is the best remedy.

Arbor Vitae Attacked by Red Cedar Bark Beetle. *Phlœosinus dentatus* Say. On August 1st sections of the trunk of a small arbor vitæ tree which seemed to be nearly dead were received from a nearby nursery. Under the bark were numerous small adult beetles with their larvæ and pupæ. Many galleries had been cut in various directions through the cambium, thus cutting off the flow of sap and effectually girdling the trees. The beetle is only one-sixteenth of an inch long, is brown or black in color, and has long been known to attack injured red cedar and white cedar, or arbor vitæ trees. There is little to be done to save the trees that are once attacked.

Maple Leaf-Stem Borer. *Priophorus acericaulis* MacG. Work of this insect was received from correspondents in Rockville on May 25th, and from Meriden on June 4th. Several years ago this insect did considerable damage by defoliating sugar maple trees in New Haven, and after repeated efforts the adult was finally obtained and proved to be a new species. It was described under the name given above by Dr. A. D. MacGillivray in *Canadian Entomologist,* vol. xxxviii, p. 306. The life history was worked out by the writer and published in *Entomological News,* vol. xvii, p. 313—1906. Since this date I have not seen the work of this insect until receiving the samples herein mentioned.

Rhododendron Lace Bug. *Leptobyrsa explanata* Heid. Rhododendrons are being injured, in some cases rather seriously, by a species of lace bug belonging to the family Tingitidæ, which has recently been described by Heidemann.* It lives on the foliage of mountain laurel and the native rhododendron, *R. maximum,* and has recently been injuring the cultivated varieties. The insect has been reported by Heidemann as occurring from Boston along the Atlantic seaboard to Florida. The insects occur in the nymph and adult stages on the under side of the leaves, where they suck out the sap. On leaves badly attacked a whitish spattered appearance is more or less prominent on the upper surface, injuring the appearance of the foliage. On the under surface are numerous brown dots, which are the excrement of the insect. Infested

* Proc. Ent. Soc. of Washington, vol. x, p. 105—1908.

leaves have been received from Rockville, South Manchester, Middlebury, and New Haven. The proper remedy is to spray the under sides of the leaves with kerosene emulsion or whale oil soap and water.

Grape Root Worm. *Fidia viticida* Walsh. This insect, which has done so much damage to vineyards of New York state, has not been conspicuous in Connecticut, but on June 28th leaves were received from Stamford showing the characteristic chain-like marks where the adult beetles had eaten the upper surface. The larvæ feed upon the roots, and thus greatly weaken the vine. The beetles are about one-fourth of an inch long, and are rather plump brown beetles, closely covered with very short grey hairs. It is a difficult insect to control, and where abundant, cultural methods, together with collecting the beetles and spraying with arsenical poisons, must be practiced.

June Beetles Defoliating Poplars. On June 13th two June beetles were received from South Lyme with the statement that they were very abundant and were defoliating Carolina poplars. The specimens belong to the genus *Lachnosterna*, the members of which are commonly known as May beetles or June beetles. The exact species has not been ascertained.

Clover Seed Chalcid. *Bruchophagus funebris,* How. A sample of clover seed was submitted to this department by Miss M. H. Jagger, seed analyst of the station. These seeds were infested, and the insect appeared to be the clover seed chalcid. This insect is distributed nearly all over the United States, and in some localities is a serious pest. The eggs are laid on the clover heads in the field, and the adult four-winged flies emerge from the ripened seeds. Early cutting of clover is a preventive.

Caterpillars on Fir from Japan. When inspecting imported nursery stock, some peculiar nests were noticed on a species of fir, *Abies tomomi,* and on examination, each was found to contain a caterpillar about an inch long. The body color was dirty white, with a ring of dark grey spots on each segment, almost forming a band or girdle. Head brown. Inflated larvæ were sent to the Bureau of Entomology at Washington, but could not be identified by anyone there. The plant was placed in a cage, and the caterpillars ate off nearly all the leaves. The specimens pupated, but we did not succeed in obtaining the adult moth.

Currant Span Worm. *Cymatophora ribearia* Fitch. On June 16th specimens of caterpillars were received from West Hartford feeding upon currant leaves. They were nearly fullgrown, and were whitish, with a wide yellow stripe along the back and a similar stripe along each side, with several black spots of different sizes on each segment. Length about one inch. There is but one generation each year, and the adult is a pretty yellow or tan-colored moth with suffused spots and markings of dark brown. It has a wing expanse of about one and one-quarter inches. Probably it will not become a pest, but if abundant, lead arsenate sprayed upon the leaves will control it.

Cluster Fly. *Pollenia rudis* Fabr. On March 5th samples of flies were received from North Stonington, with the statement that they were extremely abundant in the library building there. The fly is larger than the common house fly, and proved to be *Pollenia rudis*, a very common species which has the habit of entering unused dwellings or other buildings in large numbers late in summer and hibernating there, often becoming a great nuisance. The literature of this office contains accounts of its occurrence in several different parts of the country, though its early stages have evidently not been studied.

Pyrethrum, or insect powder, if fresh, and blown upon these flies with a powder gun or bellows, will stupefy them so that they will drop to the floor and can then be swept up and burned.

Abundance of Mocha-Stone Moth. *Melalopha inclusa.* The caterpillars of this insect feed upon the different species of poplar and willow, and were this past year more than usually common. They were observed in several different sections of the state when our men were inspecting nurseries, and considerable material was gathered. The caterpillars are gregarious and make nests or webs which remain upon the twigs and somewhat resemble the winter nests of the brown-tail moth. If examined, however, they are empty except for a few cast skins. The caterpillars do not pass the winter in them.

Scale Insect on Ferns. *Hemichionaspis aspidistræ* Sign. On March 12th, 1909, samples were received from Milford, mostly males, and on both sides of the fronds of the Boston fern. Mr. Walden found the same species on Boston fern in a large greenhouse in Cromwell on January 20th, 1910. It occurs on various plants in greenhouses, and out of doors in India, Ceylon, Brazil

and France. In India and Ceylon it is regarded as an important pest.

Caterpillars Feeding on Barberry. In August, 1908, specimens of caterpillars were received from Norwich feeding on the leaves of common barberry. They were black with white dots, and unfamiliar to us. We tried to rear the adult moths, but failed. In 1910 a large number of the same kind of caterpillars were collected and observed on Japanese barberry (*Berberis Thunbergi*). They were found on the writer's hedge and in several nurseries. Though the pupa stage was obtained, no adults have emerged at the time of this writing.

Curious Rat-tailed Pupae. *Eristalis tenax* Linn. Peculiar pupæ with long tails were received from Coventry on June 27th and from Waterbury on August 8th. This is one stage of the

FIG. 23. Rat-tailed pupa of *Eristalis tenax*, twice natural size.

well-known chrysanthemum or drone fly that is so common late in the fall around chrysanthemums in the greenhouse. It resembles a honey bee, and belongs to the family Syrphidæ, many species of which are distinctly beneficial, as the larvæ feed upon plant lice and other injurious insects. The larva of *E. tenax* also has a tail like the pupa, and lives in foul mud and manure. The tail is for respiratory purposes and is shown in Fig. 23.

Thysanurids in Seeds. On October 10th Mr. C. E. Shepard brought to the laboratory some ginseng seeds that he said appeared to be infested with minute insects. We examined several and found nothing, but finally one was found that was filled with spring-tails. Several others were in the same condition. The inside had all been eaten out, and only the shell remained. We do not know whether these insects are responsible for the destruction of the seeds or whether they entered the injured seeds after some other agency had damaged them. The species proved to be *Isotoma* (*Folsomia*) *fimetaria* (L.) Tull. and was identified by Professor J. W. Folsom.

Spring-tails in Tobacco Beds. On March 26th we received from Avon a small vial containing hundreds of spring-tails which were found in a tobacco bed, though not reported as damaging the plants. Such insects are commonly found in gardens, feeding chiefly upon vegetable matter. A few kinds injure plants. Professor J. W. Folsom was kind enough to examine the specimens, which proved to be a species of *Isotoma* which he could not identify without comparing it with European material.

a. Hedge around cemetery after cutting off dead branches.

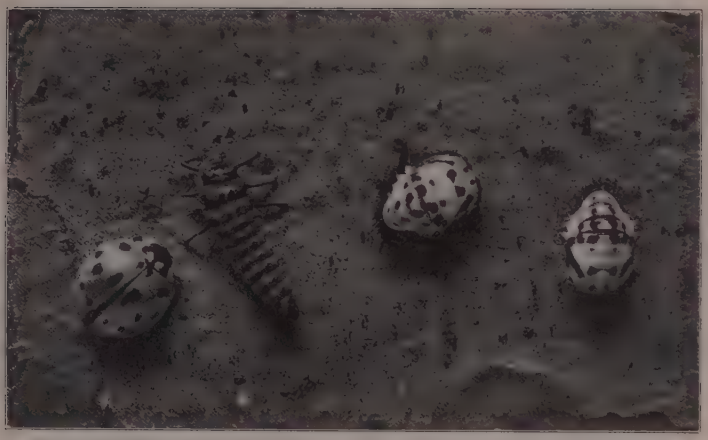
b. Spraying spruce hedge.

GYPSY MOTH WORK AT WALLINGFORD.

a. This fence, on Center Street in front of cemetery, contained many egg-clusters.

b. Retaining wall built of old railroad ties infested and replaced with masonry.

GYPSY MOTH WORK AT WALLINGFORD.



a. Larval, pupal and adult stages of 15-spotted lady beetle, natural size.

b. Pruning and cavity work on maple tree, Main Street, Wallingford.

FIFTEEN-SPOTTED LADY BEETLE: TREE WORK AT WALLINGFORD.

a. Hollow limb of pear tree containing 49 gypsy moth egg-clusters.

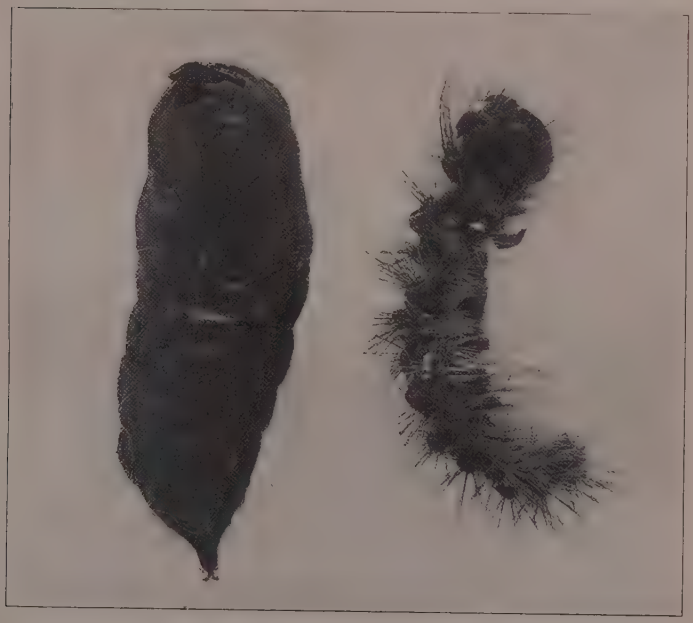
b. Pear leaf showing work of leaf blister mite, natural size.

c. Shot-gun cartridge injured by ants nesting in the box.

GYPSY MOTH EGG-CLUSTERS: WORK OF LEAF BLISTER MITE: WORK OF ANTS.

a. Fly *Tachina mella* reared from gypsy caterpillar at Wallingford.

c. *Hemiscopis cinerea*, reared from caterpillar stage, brought in on nursery stock from Japan.

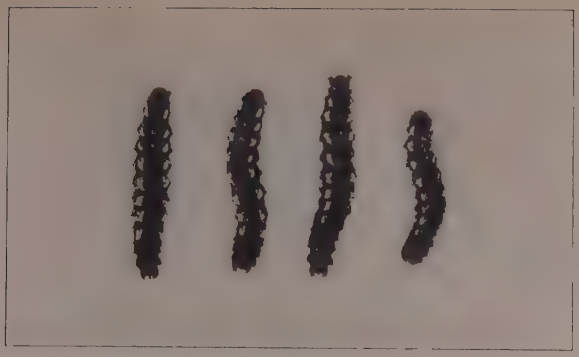


b. Cast skin of gypsy caterpillar showing eggs of parasite and gypsy cocoon from which the fly emerged.

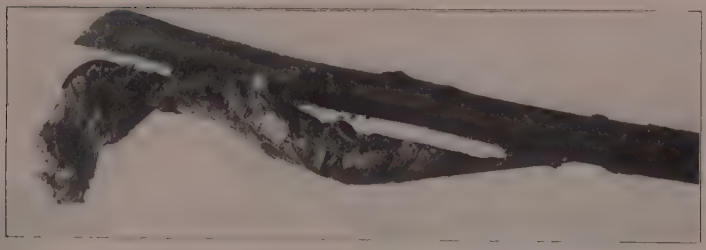
TACHINID PARASITE OF THE GYPSY MOTH: PYRALID MOTH FROM JAPAN.

a. Tree upon which the nests were first seen at Thompson.

b. Pear tree at Putnam stripped by brown-tail caterpillars in 1910.



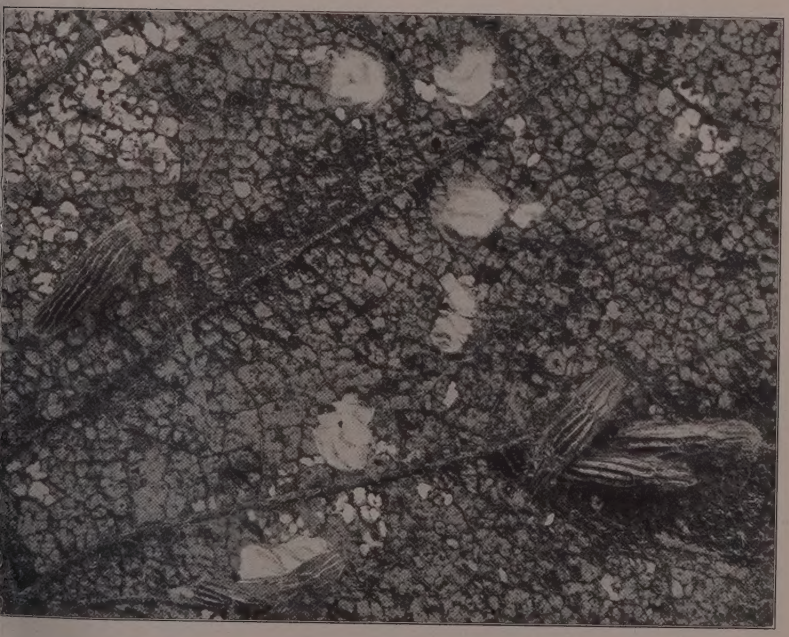
a. Brown-tail caterpillars, natural size.



b. Winter nest found on nursery stock imported from France, natural size.

c. Winter nests gathered from fruit trees at Thompson.

a. Skeletonized leaf, showing cocoons, considerably enlarged.



Section of a leaf showing ribbed cocoons and white molting cases, greatly enlarged.

WORK OF THE BIRCH BUCCULATRIX.

I. F.
E.

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